Stochastic Green's Function Method Incorporated Empirical Site Effects in Time Domain

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Site effects make a great impact on ground motions on Earth's surface, in particular at places underlain by soft soils. For make an accurate estimation of ground motion, site effects need to be quantitatively evaluated in time domain, including phase information (hereinafter called the site effects as "non-stationary site effects"), although so far only amplitude spectra of the site effects are taken into account. Akazawa et al. (2009) developed a method for estimating the non-stationary site effects using the wavelet analysis and many seismic records. The method gives average amplitude property (envelope) depending on frequency and coherent phase of seismic records. Akazawa et al. (2009) showed the applicability of the method by demonstrating for the observed seismic records for small events.
We simulate observed seismic records for large events (e.g. the 2011 Tohoku Earthquake) by incorporating the non-stationary site effects, which was proposed by Akazawa et al. (2009), with the stochastic Green's function method. Bedrock ground motions from a small event are stochastically simulated with the omega-squared model and an envelope time function depending on source size and propagation path. Bedrock ground motions from a large event are evaluated taking fault model into account in the same procedure as the empirical Green's function. Surface ground motion from the large event is calculated with a convolution of the bedrock motion with the non-stationary site effects. This method applied to some large events whose source models are known. The simulated results agree well with the obtained seismic records.

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